TMT experience, firm repertoires, and performance: A requisite variety lens

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The theory of requisite variety is often employed, but has not been subject to rigorous analysis and testing.

Requisite variety: premise and uses

The premise
The law of requisite variety (LRV) states internal variety regulates external variety (Ashby, 1956)

Top management teams
Experience (and associated cognitive) heterogeneity allows TMTs to notice, process, and respond to diverse environmental stimuli (Carpenter, Geletkanycz, & Sanders, 2004; Crossland, Zyung, Hiller, & Hambrick, 2014; Finkelstein, Hambrick, & Cannella, 2009)

Competitive dynamics
Such TMTs seem construct more complex competitive repertories (Ferrier, 2001; Hambrick, Cho, & Chen, 1996; Ndofor, Sirmon, & He, 2015)

Firm performance
In several environments, complex repertoires are associated with enhanced performance (Bogner & Barr, 2000; Connelly, Tihanyi, Ketchen, Carnes, & Ferrier, 2017; Ferrier, 2001; Lyon & Ferrier, 2002; Ndofor et al., 2015)

Concerns and paths forward

Incomplete application of LRV logic
Adaptive advantage is conditional on both capacity to generate a variety of tailored actions *and* discriminating between stimuli (Boisot & McKelvey, 2010; Heiner, 1983; Langlois, 1997)

Relatively lack of empirical evidence for LRV
Prior studies have generally avoided direct empirical tests of the LRV, relying on analytical demonstration (Poulis and Poulis, 2016)

An opportunity for rectification
An untested implication is whether heterogeneous teams match competitive repertoires to changes in environmental conditions
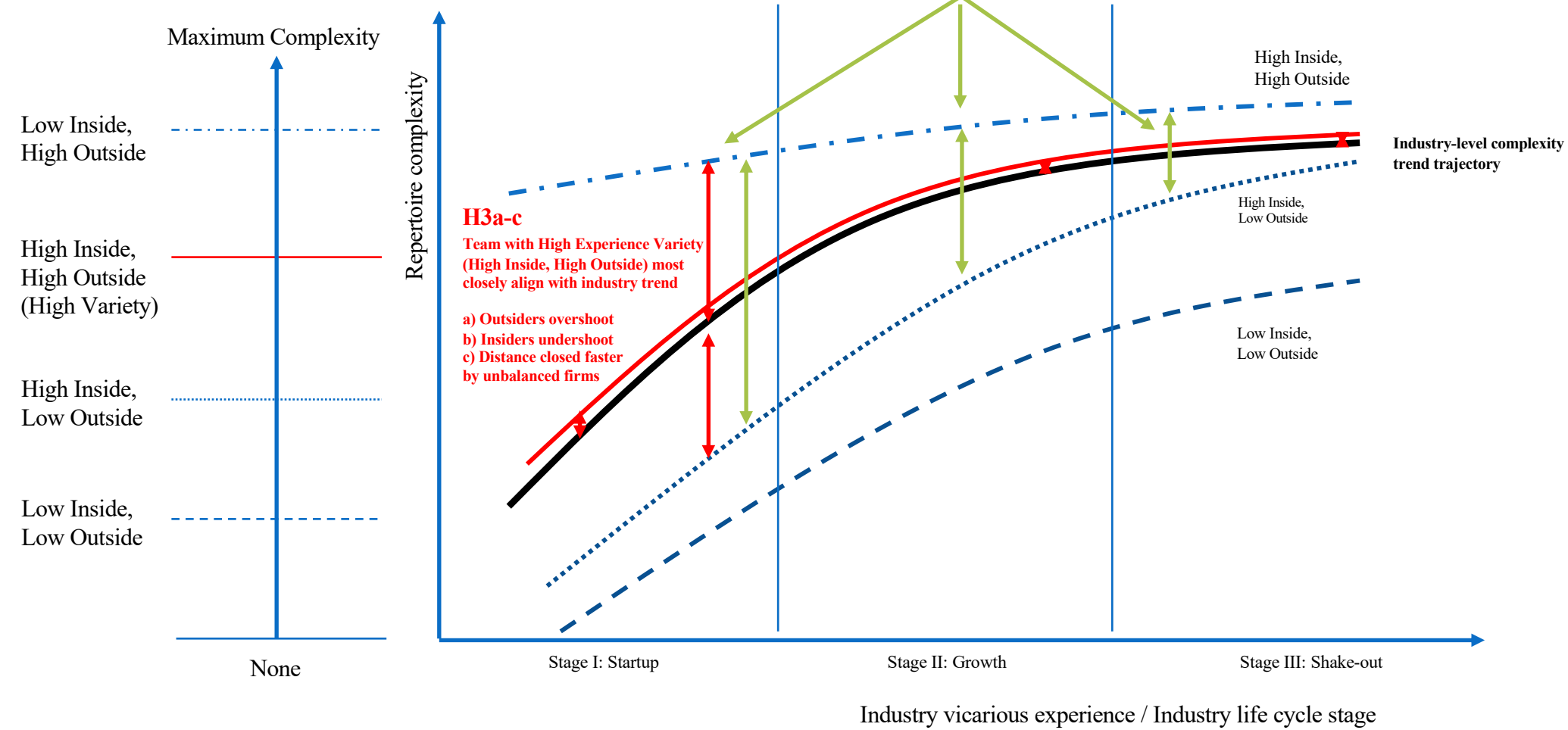
A potential way forward
Industry life cycles (Gort & Klepper, 1982) may influence environment demands and the benefits / costs of complex repertoires (Ferrier, 2001; Ferrier, Smith, & Grimm, 1999; Larraneta, Zathra, & Gonzalez, 2014; Connelly et al., 2017).

We consider how managerial experience variety translates into repertoire complexity, relative to the industry trend.

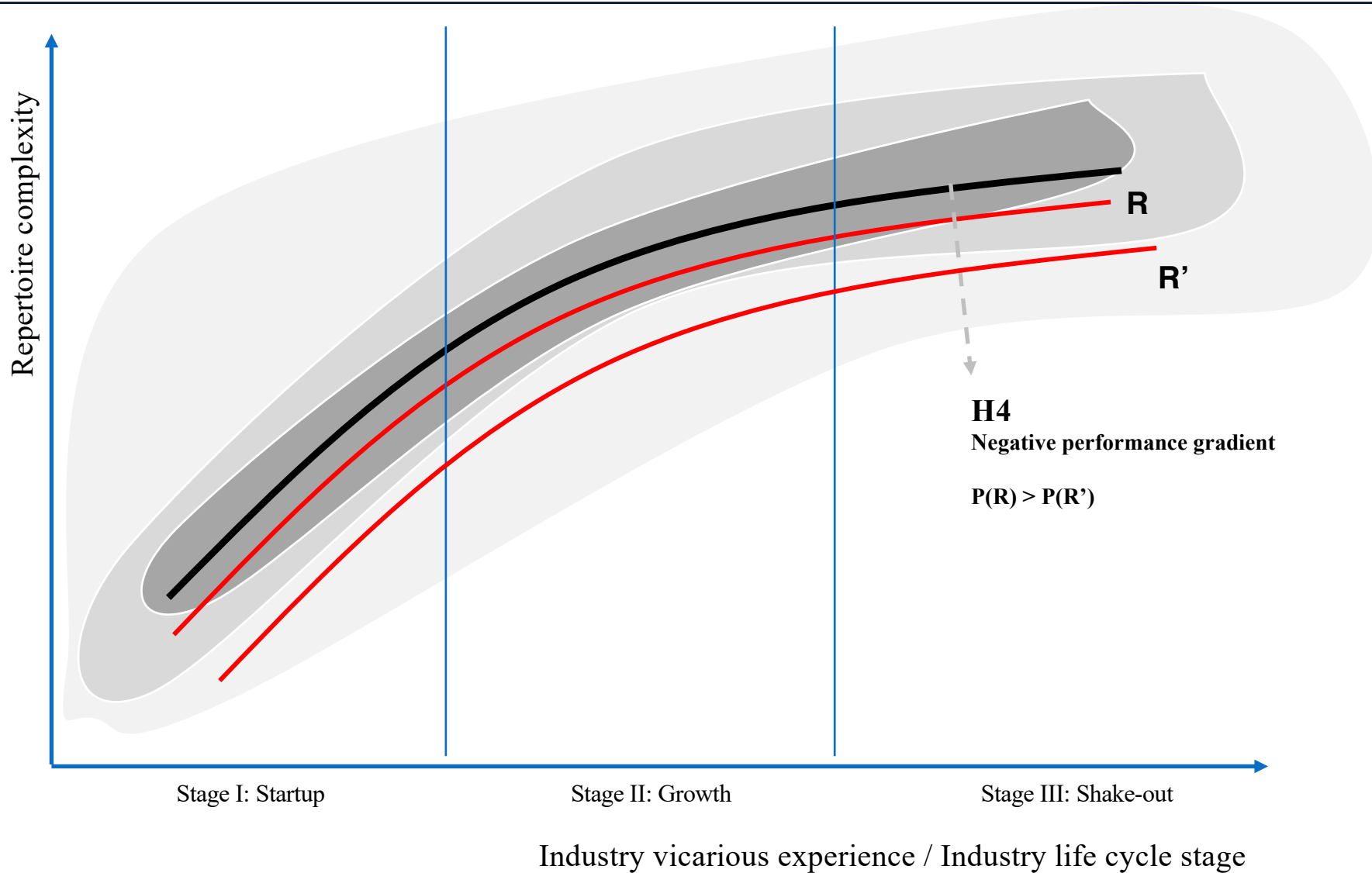As the industry evolves, so does the typical level of complexity of actions employed by firms therein.

H1a – d:
Firm complexity level depends on TMT industry experience distribution

H2
Deviations decrease in magnitude for all firms as vicarious experience increases

Maximum Complexity

Repertoire complexity

Low Inside, High Outside

High Inside, High Outside (High Variety)

High Inside, Low Outside

Low Inside, Low Outside

None

High Inside, High Outside

Industry-level complexity trend trajectory

High Inside, Low Outside

Low Inside, Low Outside

H3a-c
Team with High Experience Variety (High Inside, High Outside) most closely align with industry trend

a) Outsiders overshoot
b) Insiders undershoot
c) Distance closed faster by unbalanced firms

Stage I: Startup

Stage II: Growth

Stage III: Shake-out

Industry vicarious experience / Industry life cycle stage

We then relate this industry trend to variations in performance.

And our final hypothesis (H5) is that any relation between TMT heterogeneity and performance is via this effect.

R

R'

H4
Negative performance gradient

$P(R) > P(R')$

Repertoire complexity

Stage I: Startup   Stage II: Growth   Stage III: Shake-out

Industry vicarious experience / Industry life cycle stage

Our empirical setting allows us to observe changes in "requisite variety" and variations in managerial experience.

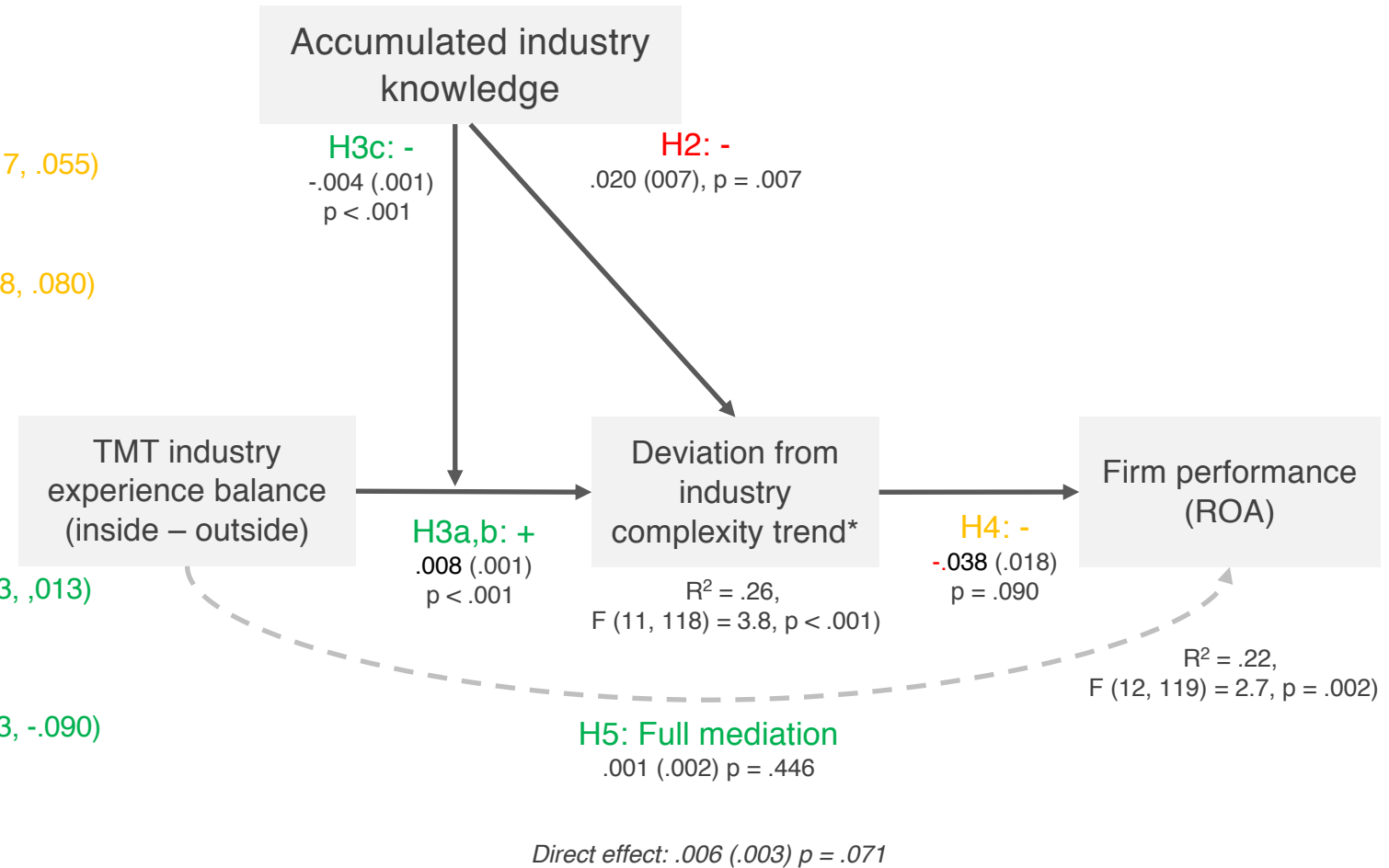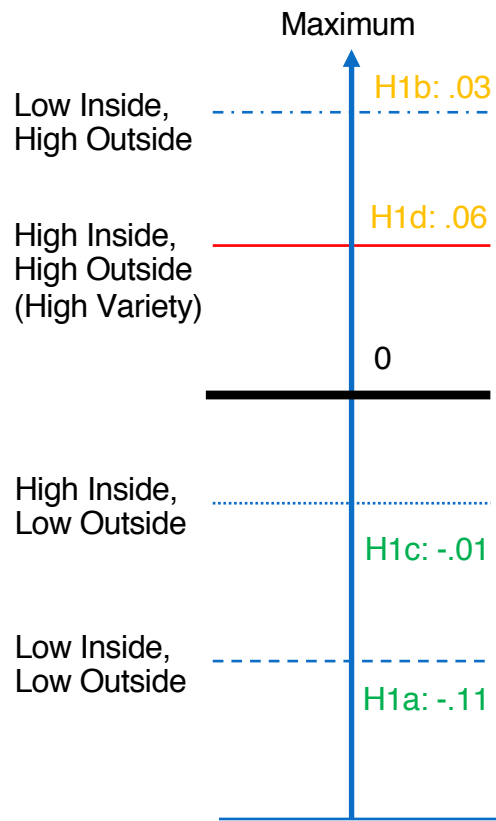| Variable	Operationalization
Industry experience variety	1) Difference and 2) Product of number of years TMT has worked in a management capacity in a) the focal industry and b) other industries
Repertoire complexity	Entropy index of repertoire components based on a portfolio of several action types (e.g., price, product, marketing, capacity, and service related)
Performance	Return on assets in the following year (t+1)
Industry life-cycle	Stage of the life cycle as determined by a generalized discriminant procedures

Data type	Sources	Observations	Coding
Managerial experience	Bloomberg; LinkedIn; Company websites; LexisNexis	346 firm-year observations of 132 executives across 24 firms	Manual
Competitive actions	Factiva	360 firm-year observations of 24 companies compiled from 11,993 actions coded from 20,179 articles	CATA with human validation
Performance	EDGAR; S&P Capital IQ; Wohler's Reports; PrivCo	221 ROA observations for 18 firms that sell 3D printers	As is, concentrated across sources
Industry structure and related data	Wohlers Reports (industry publication)	767 firm-year observations of companies within the industry from 1988-2016	Extracted from yearly reporting

Other variables of interest included total experience of each type, and other predictors of repertoires and performance, depending on the equation in question.

We find a pattern of initial results that is generally in line with our predictions.

H1a – d:
Firm complexity level depends on TMT industry experience distribution

Maximum

Low Inside, High Outside

H1b: .03 (.017, .055)

High Inside, High Outside (High Variety)

H1d: .06 (.048, .080)

0

High Inside, Low Outside

H1c: -.01 (-.03, ,013)

Low Inside, Low Outside

H1a: -.11 (-.13, -.090)

Accumulated industry knowledge

H3c: -
-.004 (.001)
p < .001

H2: -
.020 (007), p = .007

TMT industry experience balance (inside – outside)

H3a,b: +
.008 (.001)
p < .001

Deviation from industry complexity trend*

$R^2 = .26$,
$F_{(11, 118)} = 3.8$, p < .001

H4: -
-.038 (.018)
p = .090

Firm performance (ROA)

$R^2 = .22$,
$F_{(12, 119)} = 2.7$, p = .002

H5: Full mediation
.001 (.002) p = .446

Direct effect: .006 (.003) p = .071

Note: Control variables include industry total competitive activity, concentration and growth rate, firm size and age, total number of firm actions taken, publicly traded status and TMT size as well as the underlying industry complexity trend for the ROA regression. Direct effect based on absolute value of TMT experience balance. *Deviation is signed as a DV, and unsigned as an IV.

Questions our model prompts

How do we incorporate alternative explanations or means of measuring variations in TMT experience, such as the potential negative influence of group heterogeneity on group information processing?

To what extent should our findings be directed an bolstering the scaffolding of the law of requisite variety, versus contributing to a more narrow scope of the LRV in the context of top management teams and competitive dynamics?

Are there other alternative explanations for our findings that come from this literature or other related literatures that we should be concerned about and test for? What external validity threats should we be very concerned about?

Should we hypothesize and test our *a priori* expectation for the time behavior of the competitive repertoire complexity industry average?

How can our primary finding: "management teams with high levels of experience variety do not simply construct more complex repertoires; they dynamically adjust the balance between simplicity and complexity over the life cycle in a way that enhances performance" help to inform practice?